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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/833,791	04/13/2001	Walter K. Feldman	FE-493-US	1926
26456	7590	06/02/2005	EXAMINER	
WALLACE G. WALTER 5726 CLARENCE AVE ALEXANDRIA, VA 22311-1008			STEVENS, THOMAS H	
			ART UNIT	PAPER NUMBER
			2123	

DATE MAILED: 06/02/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/833,791

Applicant(s)

FELDMAN ET AL.

Examiner

Thomas H. Stevens

Art Unit

2123

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 14 February 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-13 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-13 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 14 February 2005.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

**DETAILED ACTION**

1. Claims 1-13 were examined.

***Section I: Response to Applicants' Arguments (1<sup>st</sup> Office Action)***

***Information Disclosure Statement (IDS)***

2. Examiner acknowledges and accepts IDS dated 2/14/2005.

***35 USC § 101***

3. Applicants are thanked for addressing this issue. While applicants' amendment to independent claim 1 is accepted in regard to the 101 rejection based on the first office action; however a second reading of claim 1 appears to recite little post-solution activity (last line of claim 1): *repeating the perturbing and evaluation steps while control parameters decreases the probability function with successive repetitions*. Rejection stands based on latter argument.

***35 USC § 103 (a)***

4. Applicants are thanked for addressing this issue. Applicants' arguments are persuasive to negate rejection; however, examiner has discovered new art based on amended claims.

***Section II: Non-Final Rejection (2<sup>nd</sup> Office Action)***

***Claim Rejections - 35 USC § 101***

5. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

6b. Claim 1 is rejected under 35 U.S.C. 101 because the claimed invention is directed towards a mathematical algorithm. The examiner respectfully submits, under current PTO practice, that the claimed invention does not recite a tangible or concrete result. The claims are not tangible because they appear to recite a mathematical algorithm namely used to model and analyze sub-surface natural resource reservoir in a confined or limited space that doesn't have specific post solution activity.

7. MPEP 2106, section 4.

Claims to processes that do nothing more than solve mathematical problems or manipulate abstract ideas or concepts are more complex to analyze and are addressed below. If the "acts" of a claimed process manipulate only numbers, abstract concepts or ideas, or signals representing any of the foregoing, the acts are not being applied to appropriate subject matter. Schrader, 22 F.3d at 294-95, 30 USPQ2d at 1458-59. Thus, a process consisting solely of mathematical operations, i.e., converting one set of numbers into another set of numbers, does not manipulate appropriate subject matter and thus cannot constitute a statutory process.

7b. Claims 2 and 8 are rejected under 35 U.S.C. 101 because the claimed invention is directed towards mathematical operations.

***Claim Rejections - 35 USC § 112***

8. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

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9. Claims 5 and 11 are rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure, which is not enabling. Limitations (i.e., parallelepiped of stacked prisms) are, verbatim, undisclosed within the specification.

***Claim Rejections - 35 USC § 102***

10. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

11. Claims 1-5, 7-12 are rejected under 35 U.S.C. 102(e) as being anticipated by Schweitzer et al. (U.S. Patent 6,212,952 (2001)). Schweitzer et al. teaches gravity gradient measurements taken by an accelerometer type gradiometer (abstract).

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Claim 1. A method of determining time-dependent changes in sub-surface density of a natural resource reservoir, (column 16, lines 14-16 and 48-52) comprising the steps of: measuring a set of time-lapse gravity gradient data for a sub-surface natural resource deposit (column 16, lines 14-20) characterized by a change in a density characteristic over time; creating a model of the change in density of the reservoir having a plurality of volume elements therein, including constraints on the model; establishing a set of quantized mathematically related parameters defining the density model and computing at least gravity gradients (column 3, lines 56-67) for that quantized model and computing a corresponding figure of merit therefor; perturbing at least one parameter of the model and recalculating the figure of merit for the perturbed model (column 3, lines 45-54); evaluating the figure of merit for the perturbed model relative to that of the immediately preceding model and accepting the perturbed model (column 3, lines 56-67) if more optimal relative to the immediately preceding model and accepting the perturbed model if less optimal in accordance with a probability function that varies in accordance with a control parameter; and repeating the perturbing and evaluation steps while the control parameter decreases (columns 4 and 5, lines 52-67, 1-9, respectively) the probability function with successive repetitions.

Claim 2. The method of claim 1, (column 16, lines 14-16 and 48-52; column 3, lines 45-54; columns 4 and 5, lines 52-67, 1-9, respectively) wherein the gravity gradient data includes at least the  $U_{xx} - U_{yy}$  and  $2U_{xy}$  components (column 13, lines 36-43).

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Claim 3. The method of claim 1, (column 16, lines 14-16 and 48-52; column 3, lines 45-54; columns 4 and 5, lines 52-67, 1-9, respectively) wherein the time-lapse data sets include at least the positional coordinates for a plurality of measurement sites, (columns 4 and 5, lines 52-67, 1-9, respectively) time-lapse gravity gradient data at each site, and the time between measurements.

Claim 4. The method of claim 1, (column 16, lines 14-16 and 48-52; column 3, lines 45-54; columns 4 and 5, lines 52-67, 1-9, respectively) wherein the model is a two-dimensional variable-depth column model (column 17, lines 16-41).

Claim 5. The method of claim 1, (column 16, lines 14-16 and 48-52; column 3, lines 45-54; columns 4 and 5, lines 52-67, 1-9, respectively) wherein the model is a right parallelepiped of stacked prisms arranged in a rectangular grid pattern.

Claim 7. A method of identifying the boundary or interface between a driveout (column 4, lines 40-43) fluid and to-be-recovered oil in a sub-surface (column 16, lines 14-20) oil reservoir undergoing secondary oil recovery, (column 1, lines 20-31) comprising the steps of: measuring the gravity gradient at a plurality of observation sites associated with the oil reservoir over a period of time to obtain time-displaced gravity gradients associated with each observation site; creating a change of density model of the oil reservoir having a plurality of volume elements therein, including constraints on the model; establishing a set of quantized mathematically related parameters defining the

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density model and computing at least gravity gradients (column 3, lines 56-67) for that quantized model and computing a corresponding figure of merit therefor; perturbing at least one parameter of the model and recalculating the figure of merit for the perturbed model; evaluating the figure of merit for the perturbed model relative to that of the immediately preceding model and accepting the perturbed model if more optimal relative to the immediately preceding model and accepting the perturbed model (column 3, lines 56-67) if less optimal in accordance with a probability function that varies in accordance with a control parameter; and repeating the perturbing and evaluation steps (columns 4 and 5, lines 52-67, 1-9, respectively) while the control parameter decreases the probability function with successive repetitions.

Claim 8. The method of claim 7, (column 4, lines 40-43; column 1, lines 20-31; columns 4 and 5, lines 52-67, 1-9, respectively) wherein the gravity gradient data includes at least the  $U_{xx} - U_{yy}$  and  $2U_{xy}$  components (column 13, lines 36-43).

Claim 9. The method of claim 7, (column 4, lines 40-43; column 1, lines 20-31; columns 4 and 5, lines 52-67, 1-9, respectively) wherein the time-lapse data sets include at least the positional coordinates for a plurality of measurement sites, (columns 4 and 5, lines 52-67, 1-9, respectively) time-lapse gravity gradient data at each site, and the time between measurements.



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Claim 10. The method of claim 7, (column 4, lines 40-43; column 1, lines 20-31; columns 4 and 5, lines 52-67, 1-9, respectively) wherein the model is a two-dimensional model defining a rectangular array of columns, (column 17, lines 16-41) each having a depth variable, each columns defining a volume element.

Claim 11. The method of claim 7, (column 4, lines 40-43; column 1, lines 20-31; columns 4 and 5, lines 52-67, 1-9, respectively) wherein the model is a right parallelepiped of stacked prisms arranged in a rectangular grid pattern, each prism defining a volume element.

Claim 12. The method of claim 7, (column 4, lines 40-43; column 1, lines 20-31; columns 4 and 5, lines 52-67, 1-9, respectively) wherein the set of quantized mathematically related parameters are functionally related to the changes in saturation of the oil and the driveout (column 4, lines 40-43) fluid in each volume element.

***Claim Rejections - 35 USC § 103***

12. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

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4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

14. Claims 6 and 13 are rejected under 35 U.S.C. 103 (a) as obvious by Schweitzer et al. (U.S. Patent 6,212,952 (2001)) in view of Freedman et al. (U.S. Patent 4,916,616 (1990)). Schweitzer et al. teaches gravity gradient measurements taken by an accelerometer type gradiometer (abstract) but doesn't teach penalty functions. Freedman et al. teaches responses to sub-surface formations adjacent to a well borehole (abstract) via gradient and penalty functions (column 10, lines 4-17).

At the time of invention, it would have been obvious to one of ordinary skill in the art to modify Schweitzer et al. by way of Freedman et al. to provide a new and improved method of determining the values of parameters of subsurface formations of interest in petroleum exploration and production (column 2, lines 28-35).

Claim 6. The method of claim 1, (column 16, lines 14-16 and 48-52; column 3, lines 45-54; columns 4 and 5, lines 52-67, 1-9, respectively) where said constraints are implemented by a penalty function (column 2, lines 28-35).

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Claim 13. The method of claim 7, (column 4, lines 40-43; column 1, lines 20-31; columns 4 and 5, lines 52-67, 1-9, respectively) where said constraints are implemented by a penalty function (column 2, lines 28-35).

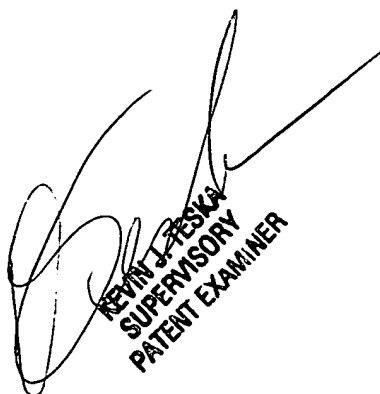
***Correspondence Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mr. Tom Stevens whose telephone number is 571-272-3715, Monday-Friday (8:00 am- 4:30 pm) or contact Supervisor Mr. Kevin Teska at (571) 272-3716. Fax number is 571-273-3715.

Any inquiry of a general nature or relating to the status of this application should be directed to the TC 2100 Group receptionist: 571-272-2100.

May 25, 2005

THS



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PATENT EXAMINER